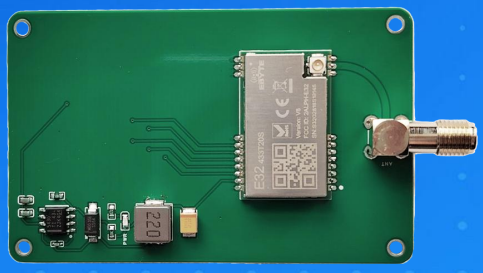
HederaTech™

AM982-LORAV1 Manual



Programmable RTK-IMU Navigation Module

- Centimeter-level Positioning
- Dual-antenna Heading
- Accelerometer & Gyroscope
- AMR Cortex-M7 MCU
- RS232, RS485, RS422 & CAN
- 433MHz Lora Wireless Transmission

Version： V1.2

Shenzhen BCTech Pty Ltd

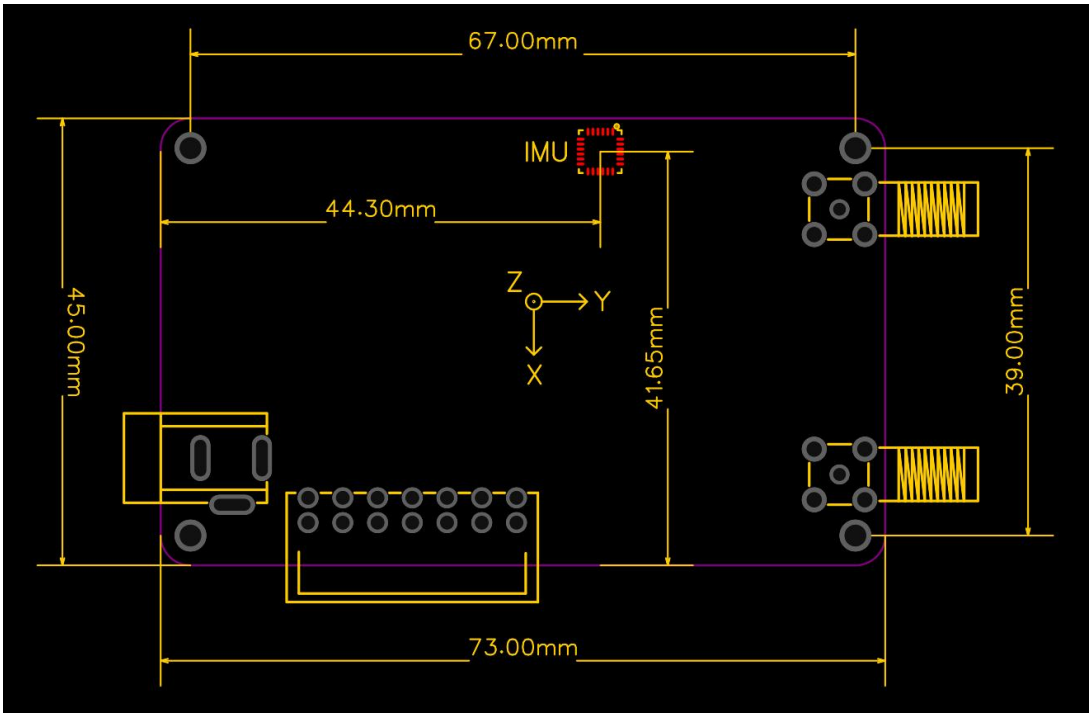
Introduction

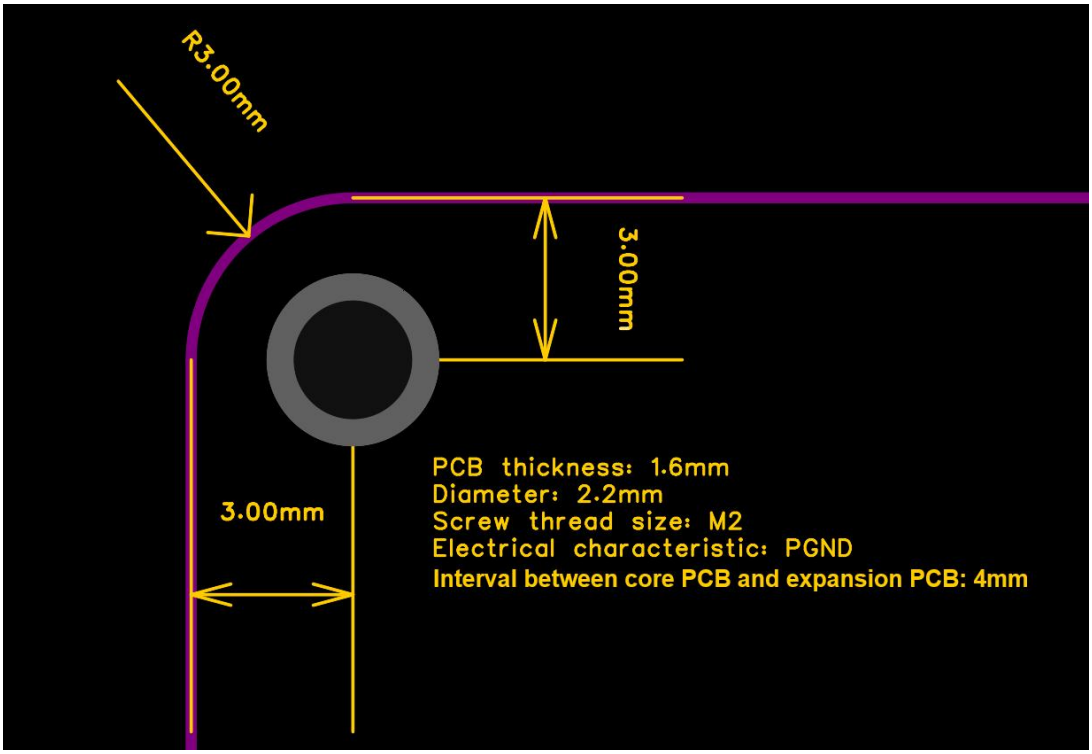
AM982-LORAV1 is a programmable multi-functional RTK-IMU navigation module based on the UM982 RTK module. The UM982 supports high-precision all-constellation multi-frequency positioning and heading with BDS, GPS, GLONASS, Galileo, QZSS, and SBAS. Additionally, a 6-axis on-board IMU is used for high-precision real-time measurement of three-dimensional acceleration and angular velocity. Moreover, a high-performance STM32H7 MCU provides enough hardware resources for the developers. Finally, RTK data is sent via 433MHz Lora wireless communication. In terms of communication, the module supports common industrial interfaces, including RS232, RS485, RS422, CAN, and USB2.0. The module is commonly used in outdoor navigation scenarios such as agricultural autopilot, patrolling, drones, unmanned boats, and lawnmowers.

Brief Description

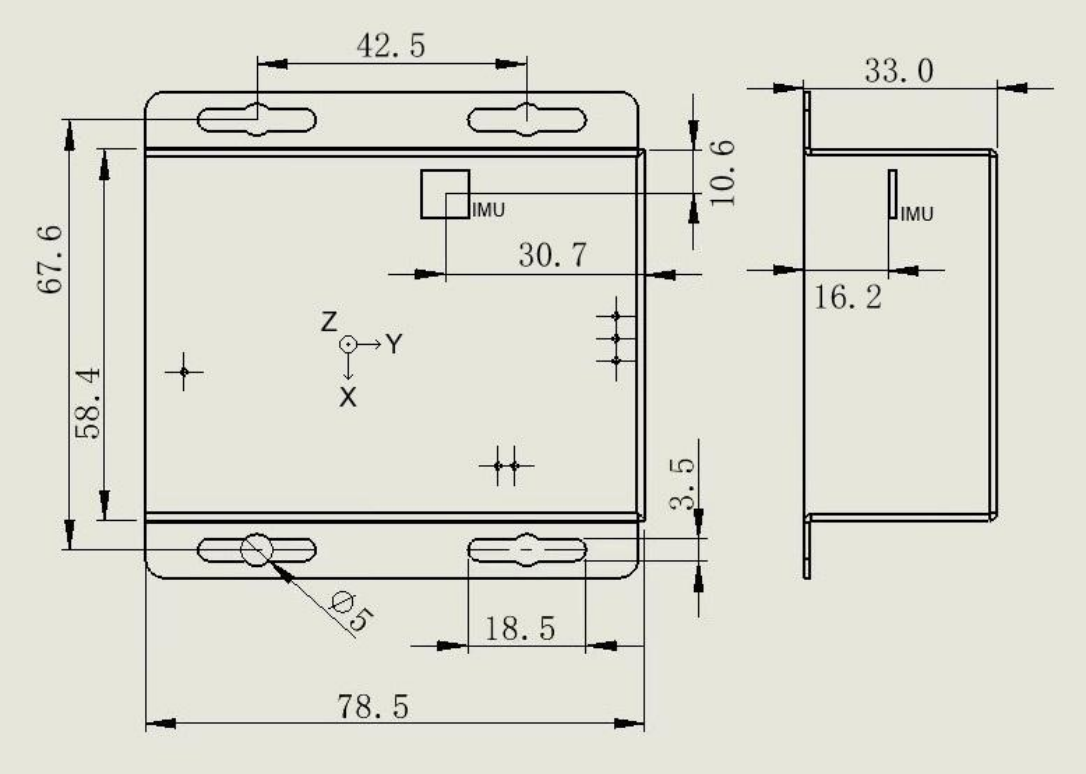
AM982-LORAV1	
MCU	STM32H723ZG, ARM Cortex-M7 CPU, frequency up to 550 MHz, 1 Mbyte flash memory, 564 Kbyte SRAM. For more details, see the STM32H723ZG manual.
RTK	UM982, 1cm of horizontal accuracy, 2cm of vertical accuracy, all-constellation all-frequency positioning and heading, supports BDS B1I/B2I/B3I + GPS L1/L2/L5 + GLONASS G1/G2 + Galileo E1/E5a/E5b + QZSS L1/L2/L5 + SBAS, self-adaptive differential RTK data like RTCM. For more details, see the UM982 manual.
IMU	MPU6050, ±2000°/sec of angular velocity range, ±16g of acceleration range. For more details, see the MPU6050 manual.
Power Requirement	DC 10-35V with at least 2W of power.
Communication Interfaces	One pluggable terminal block including two RS232 ports, one RS485 port, one RS422 port, one CAN port, one DC power supply port.
GPS Interfaces	Two SMA antenna ports with 5V power supply.
USB Interface	One full-speed Type-C USB 2.0 port.
Wireless Communication	E32-433T20S, 410-441MHz Lora with max distance of 2km.
Other Interfaces	One SWD debug port. One TTL UART port.

Mechanical Dimensions of PCBA

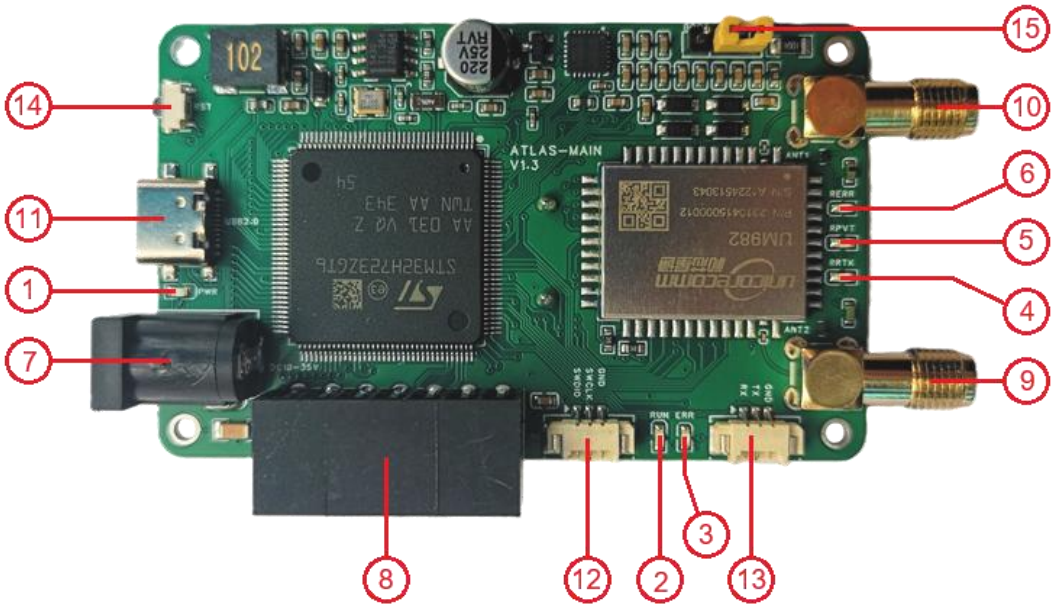




Mechanical Dimensions of Module



Ports & Indicators



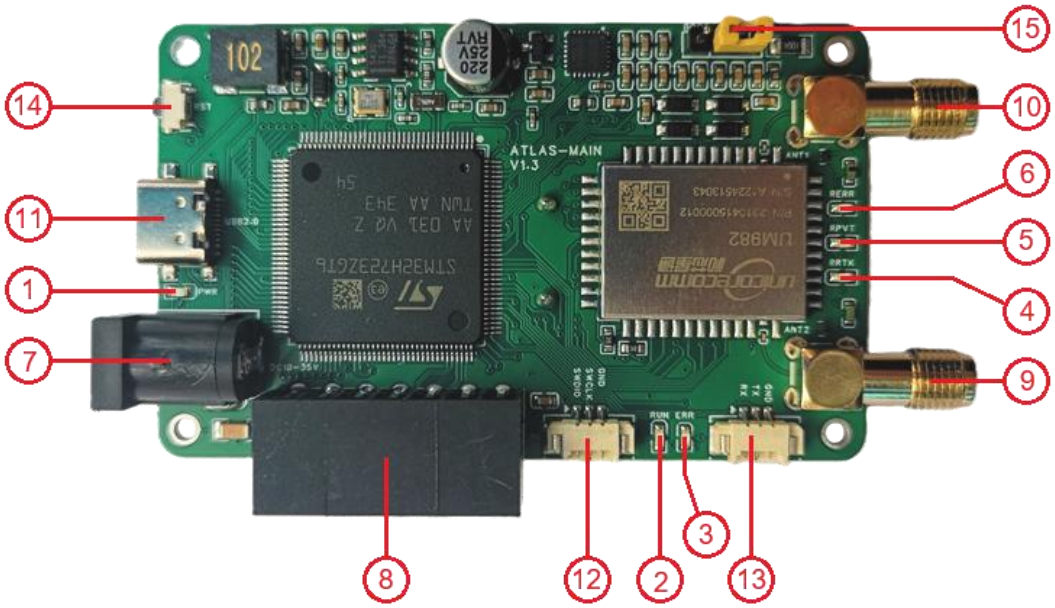
Details - MAIN Board

Type	No.	Description
LEDs	1	Green LED for power indicator.
	2	Green LED for RUNNING indicator, programmable.
	3	Red LED for ERROR indicator, programmable.
	4	Green LED for RTK fixed solution indicator.
	5	Green LED for RTK positioning indicator.
	6	Red LED for RTK ERROR indicator.
Interfaces	7	DC 10-35V input for power supply, compatible with 5.5mm DC male connector.
	8	Pluggable terminal block, compatible with KF2EDGKS-3.5-2*7P connector.

10-35V	CAN_L	RS485_A	RTK232_TX	RS232_TX	RS422_A	RS422_Y
GND	CAN_H	RS485_B	RTK232_RX	RS232_RX	RS422_B	RS422_Z
↑ Power supply for other device	↑ P	↑ P	↑ UM982	↑ P	↑ P	
Voltage same as DC input	120Ω TR	120Ω TR	COM2		120Ω TR	

P: programmable
TR: terminal resistance

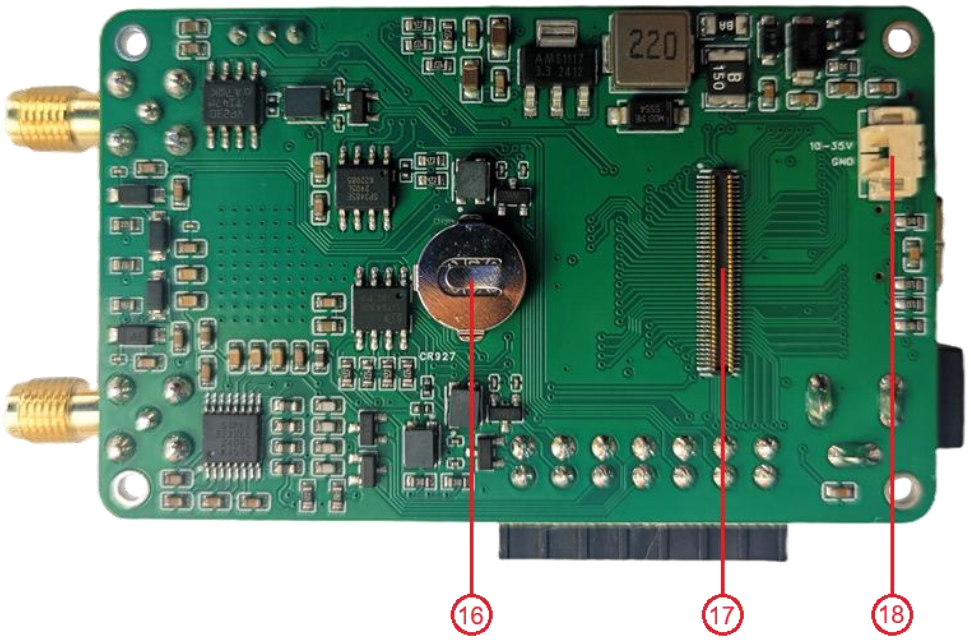
Ports & Indicators



Details - MAIN Board (continue)

Type	No.	Description		
Interfaces	9	Secondary GPS antenna with 5V power supply, compatible with SMA male connector. For rover, required if heading is needed and not required if only positioning is needed. For base, not required.		
	10	Primary GPS antenna with 5V power supply, compatible with SMA male connector.		
	11	Full-speed USB2.0 port, compatible with USB Type-C male connector. Can be used to power the module with no more than 5V.		
	12	STM32 SWD debug port, compatible with 1.25mm male connector.		
		SWDIO	SWCLK	GND
	13	STM32 UART port on 3.3V TTL, compatible with 1.25mm male connector.		
		RX	TX	GND
Button	14	Reset button.		
Headers	15	Selecting of STM32 BOOT mode by a jumper.		
		3.3V	BOOT	GND

Ports & Indicators

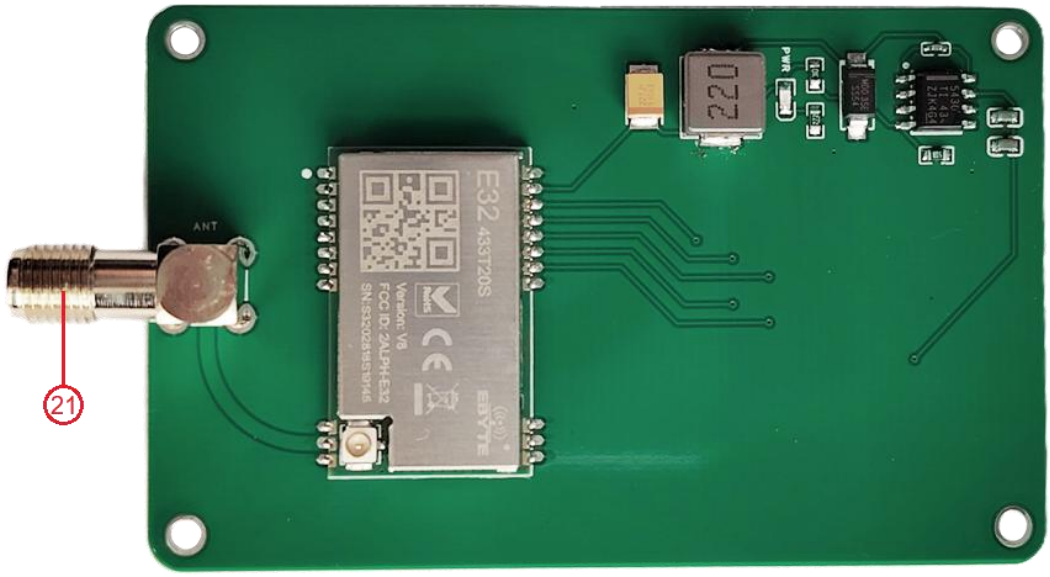


Details - MAIN Board (continue)			
Type	No.	Description	
Battery	16	CR927 battery with 3V power supply for backup domain of MCU and UM982.	
Interfaces	17	Expansion card connector. For more details, contact us.	
	18	Expansion card power supply, compatible with 1.25mm male connector. Voltage same as DC input.	
		Positive	Negative

Ports & Indicators

Details - LORA Board			
Type	No.	Description	
Interfaces	19	MAIN card DC 10-35V power input, compatible with 1.25mm male connector.	
		Positive	Negative
	20	MAIN card connector, 4mm height. For more details, contact us.	

Ports & Indicators



Details - LORA Board (continue)		
Type	No.	Description
Interfaces	21	Lora antenna, compatible with SMA male connector.

STM32 Hardware Configuration

Details		
MCU Model	STM32H723ZG	
HSE	25 MHz	
LSE	32.768 kHz	
USB2.0 Port	PA11 PA12	STM32 USB2.0 Port.
SWD Port	PA13 PA14	STM32 SWD Debug Port.
UART Port	PD0 PD1	UART4 for STM32 3.3V TTL Serial Port.
LEDs	PC11	LED for RUNNING indicator. Pull it high for turning on.
	PD3	LED for ERROR indicator. Pull it high for turning on.
Power Voltage Detector	PB7	PVD_IN connecting to 3.3V VCC.
IMU Module	PG10	Output for MPU6050 power control. Pull it low for powering.
	PF0 PF1	I2C5 for MPU6050 I2C (ADDR: b1101000).
	PG13	Output for MPU6050 CLKIN signal.
	PE0	Output for MPU6050 FSYNC signal.
	PE1	Input for MPU6050 INT signal.
RTK Module	PD14 PD15	UART9 for UM982 COM1.
	PD5 PD6	USART2 for UM982 COM3.
	PD4	Output for UM982 RESET_N. Pull it low for more than 5ms for resetting.
	PD7	Input for UM982 PPS signal.

STM32 Hardware Configuration

Details (continue)		
RS232	PG9 PG14	USART6 for RS232 port.
RS485	PB3 PB4	UART7 for RS485 port.
	PG15	Output for RE/DE. Pull it low for receiving and high for sending.
RS422	PC12 PD2	UART5 for RS422 port.
CAN	PB5 PB6	FDCAN2 for CAN port.
Lora Module	PG11 PG12	USART10 for E32-433T20S UART.
	PC8	Input for E32-433T20S AUX signal.
	PA8	Output for E32-433T20S M0 signal.
	PC9	Output for E32-433T20S M1 signal.

RTK Information

Parameters			
Basic Information	RTK Model	UM982	
	Channels	1408 Channels	
	Constellations	BDS/GPS/GLONASS/Galileo/QZSS	
	Master Antenna Frequencies	BDS: B1I, B2I, B3I GPS: L1C/A, L2P (Y)/L2C, L5 GLONASS: G1, G2 Galileo: E1, E5a, E5b QZSS: L1, L2, L5	
	Slave Antenna Frequencies	BDS: B1I, B2I, B3I GPS: L1C/A, L2C GLONASS: G1, G2 Galileo: E1, E5b QZSS: L1, L2	
Performance	Positioning Accuracy	Single Point Positioning (RMS)	Horizontal: 1.5 m
			Vertical: 2.5 m
		DGPS (RMS)	Horizontal: 0.4 m + 1 ppm
			Vertical: 0.8 m + 1 ppm
		RTK (RMS)	Horizontal: 0.8 cm + 1 ppm
			Vertical: 1.5 cm + 1 ppm
		PPP (RMS)	Horizontal: 5 cm
			Vertical: 10 cm

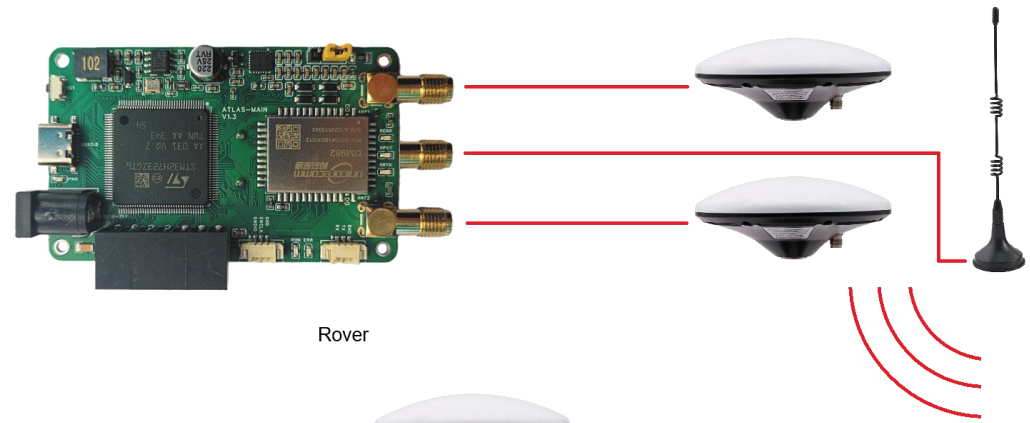
RTK Information

Parameters (continue)					
Performance	Observation Accuracy (RMS)	BDS	GPS	GLONASS	Galileo
	B1I/L1 C/A/G1/E1 Pseudorange	10cm	10cm	10cm	10cm
	B1I/L1 C/A/G1/E1 Carrier Phase	1mm	1mm	1mm	1mm
	B3I/L2P(Y)/L2C/G2 Pseudorange	10cm	10cm	10cm	10cm
	B3I/L2P(Y)/L2C/G2 Carrier Phase	1mm	1mm	1mm	1mm
	B2I/L5/E5a/E5b Pseudorange	10cm	10cm	10cm	10cm
	B2I/L5/E5a/E5b Carrier Phase	1mm	1mm	1mm	1mm
	Heading Accuracy (RMS)	0.1 °/1 m Baseline			
	Time Pulse Accuracy (RMS)	20 ns			
	Velocity Accuracy (RMS)	0.03 m/s			
	Time to First Fix	Cold Start < 30 s			
		Hot Start < 4 s			
	Initialization Time	< 5 s (Typical)			
	Initialization Reliability	> 99.9%			
	Data Update Rate	20 Hz Positioning & Heading			
		20 Hz Raw Data Observation			
	Differential Data	RTCM 3.X			
	Data Format	NMEA-0183, Unicore			

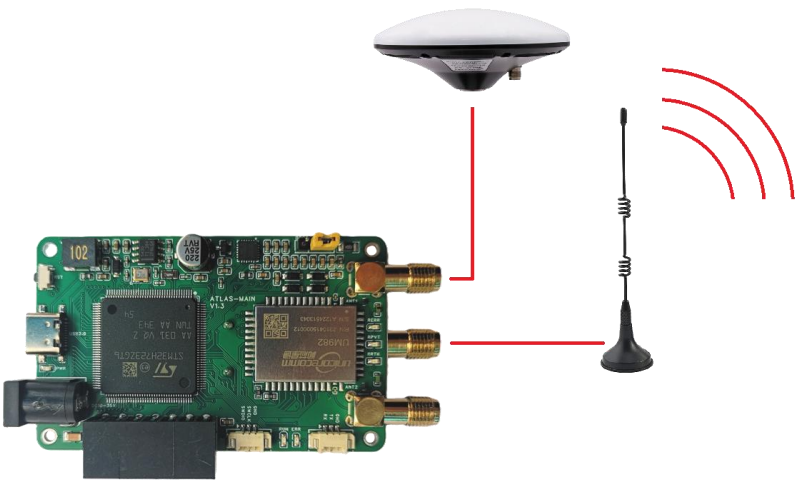
Lora Information

Parameters	
Lora Model	E32-433T20S
Frequency	410 MHz + n * 1 MHz (n=0, 1, ..., 31)
Transmission Power	10/14/17/20 dBm
Max UART Baud Rate	115200 bps
Max Air Baud Rate	19.2 kbps
Max Distance for RTK	2 km

RTK Base & Rover Electrical Diagram

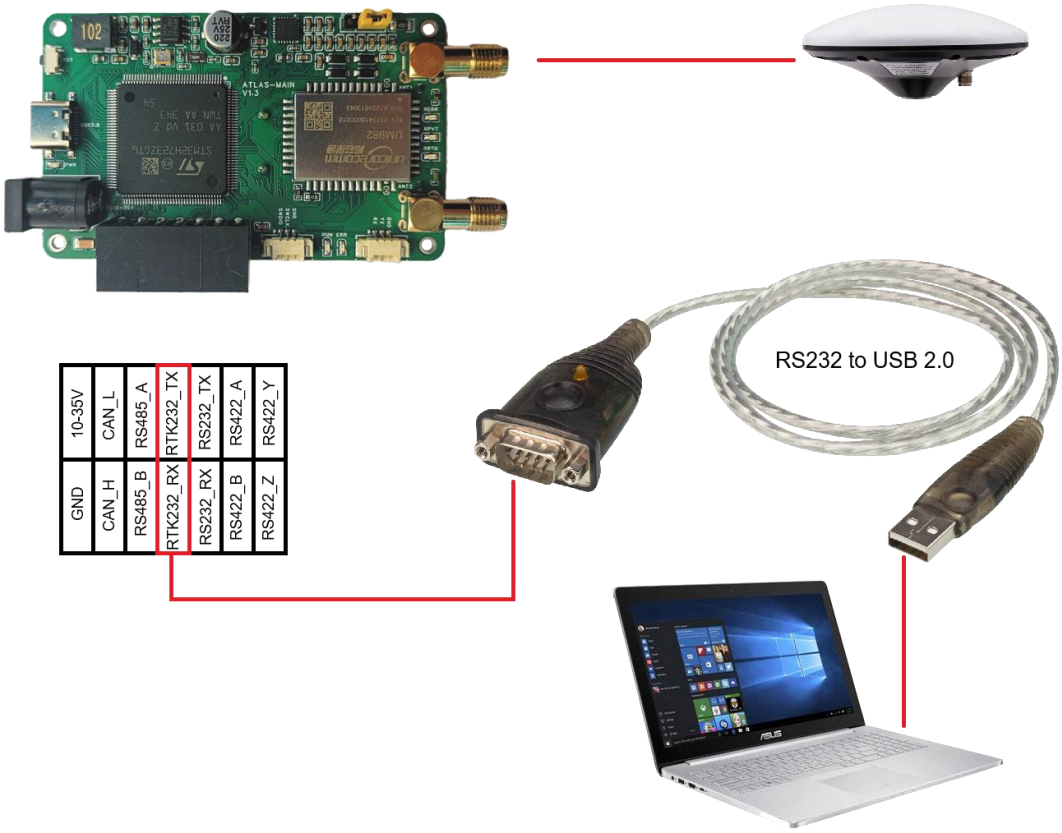


Rover



Base

Connection between RTK Module and PC



Via USB to RS232 converter, we can connect the UM982 COM2 to PC. Then, the UM982 can be set and view by using serial tool software or UPrecise software. UPrecise software is used specifically for Unicore RTK modules setting and viewing.

Quick Start

IMU Start & Configuration

1. Pull the PG10 high and, after 2s, pull it low to start the IMU.
2. Write the following registers via I2C5 at the address b1101000:

```
Register: 0x6b -> Value: 0x00    // Initialize IMU
Register: 0x6c -> Value: 0x00    // Enable all axes
Register: 0x38 -> Value: 0x00    // Disable interrupt
Register: 0x19 -> Value: 0x09    // Set sampling frequency 100Hz
Register: 0x1a -> Value: 0x06    // Set low pass filter frequency 1kHz
Register: 0x1b -> Value: 0x18    // Set range 2000°/s
Register: 0x1c -> Value: 0x00    // Set range 2g
```

RTK Start & Configuration - Base

1. Pull the PD4 low and, after 10ms, pull it high to start the RTK.
2. Send following strings via UART9:

```
freset                  // Default settings
mode base time 60       // Set base 60s automatic positioning
rtcm1006 com2 10        // Reference point coordinates
rtcm1033 com2 10        // Receiver and antenna description
rtcm1074 com2 1         // GPS correction data
rtcm1124 com2 1         // BDS correction data
rtcm1084 com2 1         // GLONASS correction data
rtcm1094 com2 1         // Galileo correction data
saveconfig              // Save configuration
```

RTK Start & Configuration - Rover

1. Pull the PD4 low and, after 10ms, pull it high to start the RTK.
2. Send following strings via UART9:

```
freset                  // Default settings
mode rover              // Set rover
gpgga com3 1            // Receive 1Hz positioning from USART2
gpths com3 1            // Receive 1Hz heading from USART2
saveconfig              // Save configuration
```

Quick Start

Lora Start & Configuration

1. Wait 100ms after powering and pull the PA8 and PC9 high.
2. Wait 100ms and send the following data via USART10:

[0xc2,0x00,0x00,0x3d,0x17,0x40] //Address 0x0000 and channel 0x17

3. Wait 100ms and pull the PA8 and PC9 low.

Software

Firmware: https://github.com/BCircleTech/am982-stdv1-firmware
PC tool: https://github.com/BCircleTech/am-viewer
UPrecise Software: https://en.unicore.com/products/uprecise.html

Contact Us

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